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SOME PINEAPPLE PROBLEMS.

4th ARTICLE. - SOIL REACTION AND THE STATE OF THE COLLOIDAL MATTER IN THE SOIL.

By Henry C. Henricksen.

THE TERM REACTION. - A soil is said to be acid if it changes the color of litmus paper from blue to red and it is said to be alkaline if it changes the color from red to blue. The litmus test is not very delicate, however, and it does not give all the desired information. Better results are obtained with sets of indicators that are more delicate than litmus. A set of such indicators with color chart and directions for use can be obtained for a few dollars.

SOIL SAMPLING. - The information desired in this case is the reaction of the soil solution for that is the medium in which the plant roots grow and the source from which it draws its nourishment. This solution as it exists in the soil is not readily obtainable but that obtained by the leaching method is satisfactory for the present purpose. Collect the 20 to 50 cc water that drops into the bottle as described in the former article under weight determination. If the water is poured onto the soil core very slowly it is not liable to leach through except where there happens to be a natural channel, such as an insect burrow. Usually the water added forces that which is already present farther down into the soil. Therefore the first portion collected is water which has been in contact with the soil for some time, in other words it is the soil solution. This method of obtaining samples for determination has the special advantage that the solution is clear. Where a portion of soil is stirred up with water it is often difficult to obtain a clear solution. To stir up about a tablespoonful soil in a glass of rainwater is satisfactory provided the colloidal matter will flocculate and leave a clear solution upon which the test can be made.

THE USE OF INDICATORS. - Take about 5 cc of the soil water and add 1 to 2 drops of an indicator as described in the directions following the indicator set. The color obtained will show the approximate range of acidity, and one or two additional samples with other indicators will establish the exact point. The values obtained range from 1 to 14 in graduations of two-tenths, the lower number denoting extreme acidity, the upper number extreme alkalinity and the middle number, 7, the neutral point. The figures are termed pH values, meaning the hydrogen-ion-potentiality.

THE RELATION OF THE pH VALUE OF THE SOIL SOLUTION TO THE GROWTH OF THE PINEAPPLE PLANT. - When the pH value is numerically above 7 the soil is, at least temporarily, unfit for pineapple growing. When the value is from 6 to 7 it is very doubtful if it will produce a good crop although if it is 6. to 6.2 and the solution filters clear it may do so. The pH value of the soil solution may be any number of points below 6 without the soil being unsuitable for pineapple growing. No natural soil in Porto Rico is so acid that it will not, for that reason, produce pineapples.

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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

WASHINGTON, D. C., 1915

REPORT OF THE

COMMISSIONER OF PLANT INDUSTRY

FOR THE YEAR 1914

The following report contains a summary of the work of the Bureau of Plant Industry during the year 1914. It is divided into two parts, the first of which contains a general statement of the work of the Bureau, and the second of which contains a detailed statement of the work of the various divisions of the Bureau.

The first part of the report contains a general statement of the work of the Bureau during the year 1914. It is divided into two sections, the first of which contains a statement of the work of the Bureau as a whole, and the second of which contains a statement of the work of the various divisions of the Bureau.

The second part of the report contains a detailed statement of the work of the various divisions of the Bureau during the year 1914. It is divided into five sections, the first of which contains a statement of the work of the Division of Plant Industry, the second of which contains a statement of the work of the Division of Plant Pathology, the third of which contains a statement of the work of the Division of Plant Breeding, the fourth of which contains a statement of the work of the Division of Plant Physiology, and the fifth of which contains a statement of the work of the Division of Plant Anatomy.

The third part of the report contains a statement of the work of the Bureau during the year 1914, as compared with the work of the Bureau during the year 1913. It is divided into two sections, the first of which contains a statement of the work of the Bureau as a whole, and the second of which contains a statement of the work of the various divisions of the Bureau.

The fourth part of the report contains a statement of the work of the Bureau during the year 1914, as compared with the work of the Bureau during the year 1912. It is divided into two sections, the first of which contains a statement of the work of the Bureau as a whole, and the second of which contains a statement of the work of the various divisions of the Bureau.

The fifth part of the report contains a statement of the work of the Bureau during the year 1914, as compared with the work of the Bureau during the year 1911. It is divided into two sections, the first of which contains a statement of the work of the Bureau as a whole, and the second of which contains a statement of the work of the various divisions of the Bureau.

The sixth part of the report contains a statement of the work of the Bureau during the year 1914, as compared with the work of the Bureau during the year 1910. It is divided into two sections, the first of which contains a statement of the work of the Bureau as a whole, and the second of which contains a statement of the work of the various divisions of the Bureau.

THE STATE OF THE COLLOIDAL MATTER IN THE SOIL. - When a soil is stirred up in water it may settle quickly or part of it may remain in suspension for a very long time. The behavior of a soil in that respect may be made use of, within certain limits, in determining whether or not it is suitable for pineapple growing. In a field with sandy soil in which there are spots of poor plants the soil producing good plants will usually filter or settle clear whereas the soil from spots producing poor plants will not do so. In clay soil the difference is not always so sharply drawn although on new land it usually is. The results, from many fields in which the land has been producing pasture for a number of years before planting pineapples, show that the soils producing good plants filter or settle clear when stirred up with water, whereas from spots producing poor plants some of it is liable to remain in suspension. Also the clay subsoil in some fields gives a clear solution and when it does it is beneficial to the pineapple plant when it is brought to the surface and mixed with surface soil. The benefit produced is not due to the soil itself but rather to a condition that is measurable by the state of its colloidal matter for after that is changed it has not the same beneficial action. The soil, when it is exposed to the atmosphere, planted, cultivated and fertilized, changes in respect to the state of its colloidal matter; fertilizing, especially, may cause a very decided change in a short time. It is undoubtedly along that line the beneficial effect of ammonium sulphate can be explained for that is a very good precipitant of soil colloidal matter. The beneficial effect of sulphur, which will be described in another article, is along the same lines. Sulphur is oxidized in the soil forming sulphuric acid which in itself is a good clay precipitant as all acids are although they vary one from another in that respect. Many salts will also cause precipitation, one of the most effective is aluminum sulfate which, together with other sulfates, is formed in the soil as a result of an application of sulphur. Ammonium alum, being ammonium/aluminum sulphate or potassium alum, being aluminum potassium sulphate, are both beneficial when applied to some soils, the benefit being much greater than that derived from corresponding applications of ammonium sulphate or potassium sulphate.

SUMMARY. - With the pH indicators the colors produced should show an acidity numerically below 6. If above that the soil is probably unsuitable or it is liable to become so soon after planting. If the pH is towards 7 or above that the soil is unquestionably unsuitable, at least temporarily so. If the pH is considerably below 6 suitability is indicated but not assured unless the soil settles clear after being stirred up with water. Settlement is sometimes slow but if the water becomes clear in a few hours it is satisfactory. It must be clear, however, not milky, especially if the soil contains considerable charcoal. That aids flocculation, but being the residue from burned plant material it is usually accompanied by basic salts in the presence of which the flocculation is incomplete. The presence of such salts is inimical to the normal development of the pineapple plant.

